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Lines and Shapes

A "new look" is emerging in the architecture of plants, one ordained not by nature but by man. For lines, curves, and angles, while intrinsic to plantlife, are assuming greater importance as agricultural science redesigns and reshapes plants to meet changing needs.

An overview of this trend can be observed in tomato fields, the bulk of which are harvested mechanically. There today's tomato varieties, compared with yesterday's, possess more compact vines, fewer leaves, and oblong fruits. Although compact, the vines develop many lateral but few single stems, thereby presenting a wide swath to the rumbling machines which straddle the rows and in one pass make short work of harvesting a crop of tomatoes bred to ripen together. Fewer but more efficient leaves, on the other hand, foster a drier microclimate around tomato clusters, one that is less hospitable to moisture-loving disease organisms.

Another genetically-induced structural change involves the bounteous wheat of Green Revolution fame. Breeders designed these crop plants to have shorter and stiffer straws—traits that permit heavy rates of fertilizer application without loss of plants to lodging. The strengthened straw, along with genes for high yields, more fertilizer, and improved management practices, has increased wheat crops in areas of adaptation in India and Mexico by five and six fold.

The shear and saw, not genetics, are the main tools for redesigning tomorrow's orchard trees. With mechanical harvesting of apples still in its infancy, varied efforts are underway to mold the tree to the machine. Trees are being pruned to grapevine-like forms about six feet high and only three feet wide when in full foliage to enable a harvesting machine to travel along the row; other trees are being pruned with slot-like openings to receive the machine with its shaker and fruit-catching canopy.

Even as man strives to build a new order, he sometimes returns to the old. In pruning today's landscape shrubs, for example, the trend is to a sculptured form that is natural with open and flowing lines, a marked contrast with recently favored dense and mushroom-like forms. The future holds many unknown changes and needs. But working as a partner of nature, aware of her laws, man can train plants to work for him while still preserving their diversity and essence.—*R.P.K.*

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COVER: Irrigation water is cleaned before it re-enters the river. Sand and silt particles in this stream settle out at the head of the pond; the smaller clay particles are deposited toward the outlet end of the pond (0874X1359–13). Article begins on page 8.

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Bob S. Bergland, Secretary
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Dr. Han and pilot plant engineer Glenn A. Grant make final adjustments to the pilot plant prior to a fermentation run. The plant, which is designed to function as mixer and pressure cooker as well as fermentor, can produce up to 300 pounds of fermented straw per day (1176X1467–5).

Feed from straw

A TREMENDOUS waste disposal problem may become a tremendous animal feed source if pilot plant study results confirm the findings of laboratory studies.

By using a semisolid fermentation process, straw from grain crops can be easily and inexpensively converted into a high-protein animal feed. Fermenting the straw increases its protein content to 7–10 percent and its digestibility to 46 percent.

More than 200 million tons of straw are produced annually in the United States alone. Other countries, such as India, face even larger straw disposal problems. Farmers used to burn their straw, but many States now prohibit this air-polluting practice.

Past attempts to produce animal feed from straw have failed because of process cost or unacceptable feed value. But the fermentation method developed by ARS microbiologist Youn W. Han (Agricultural Experiment Station, 1057 Cordley Hall, Oregon State University, Corvallis, OR 97331), and microbiologist Arthur W. Anderson, Oregon State University, avoids the pitfalls of past efforts.

Their process, which is similar to the procedures used in the Orient to make

Research assistant Sheila Smith uses an autoclave to pressure cook straw samples which will be used for yeast cultivation. The yeast itself cannot utilize the cellulose, which makes up the bulk of straw, but does thrive on sugars produced from cellulose, thus making straw more digestible and higher in protein (1176X1466–24).

koji, is inexpensive and employs simple equipment. There is no need for special controls for pH, temperature, foaming, or aeration, and all of the final product is used.

Basically the fermentation process involves the growing of micro-organisms on semisolid straw substrate. As straw is normally resistant to microbial degradation, pretreatment is necessary.

The straw is first chopped to ¼- to 1-inch lengths or smaller, using a hammer mill, knife grinder, or attrition mill, and conveyed to a pressure cooker. Before being placed in the cooker, one part of straw is sprayed with three parts of a 0.5 normal sulfuric acid solution.

The straw is hydrolized in the pressure cooker under 15 pounds of steam for 30 minutes, treated with ammonia or ammonium hydroxide, then conveyed to a fermentation chamber.

The treatment of the straw with acid and subsequent neutralization with ammonia produces a straw containing 20 percent fermentable sugars and 2.3 percent nitrogen, which is a suitable condition for yeast fermentation.

Micro-organisms in the form of yeast are added and the fermentation is carried out aerobically on a semisolid substrate. The fermentor must maintain a constant tumbling motion of the straw or permit a free exchange of air in some manner. The straw remains in the fermentor for 35 hours before being removed and dried with hot air.

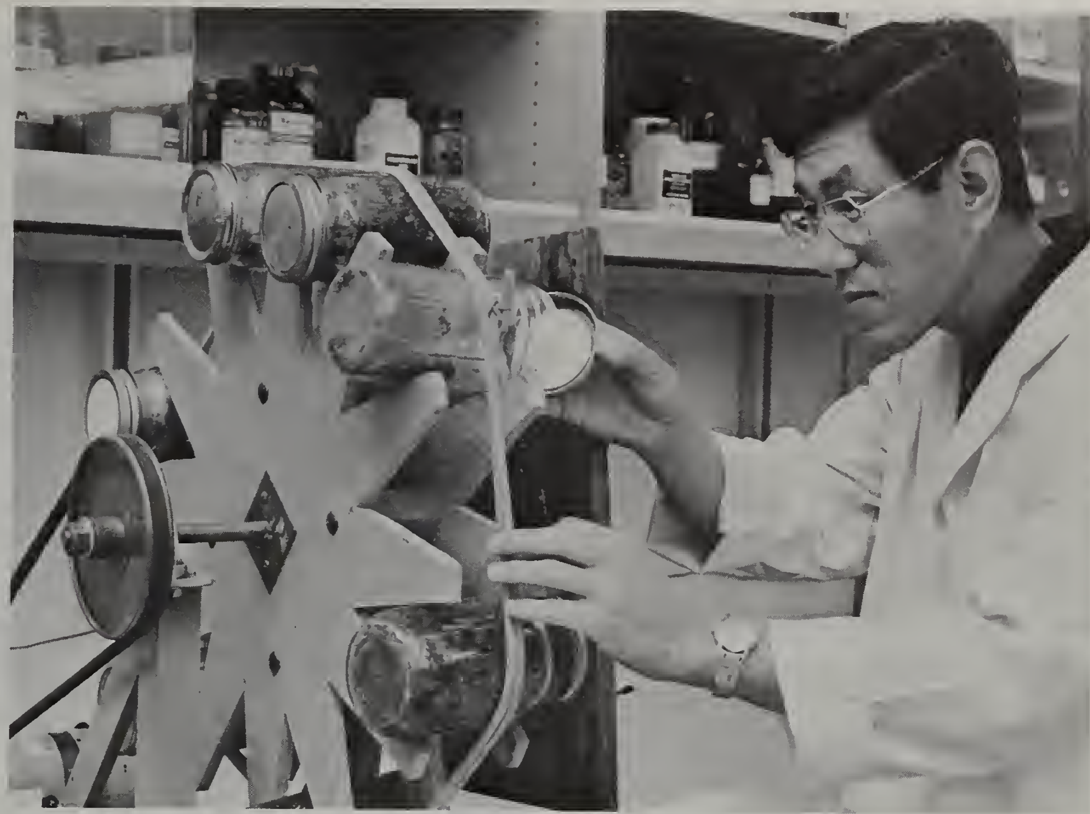
The fermented product is brown in color and has a pleasant molasses aroma. Crude protein content in the straw has been increased from 3.1 to 7–10 percent. The digestibility has been increased from 32.7 to 46.6 percent of the straw.

So far, the process has worked successfully with such grasses as rice, ryegrass, wheat, oats, and barley. The application of this work is worldwide.

Dr. Anderson and Dr. Han prepare inoculum (micro-organisms in the form of yeast) for the pilot plant. The yeast was grown on hydrolized straw to acclimate the culture for straw fermentation (1176X1465–32).

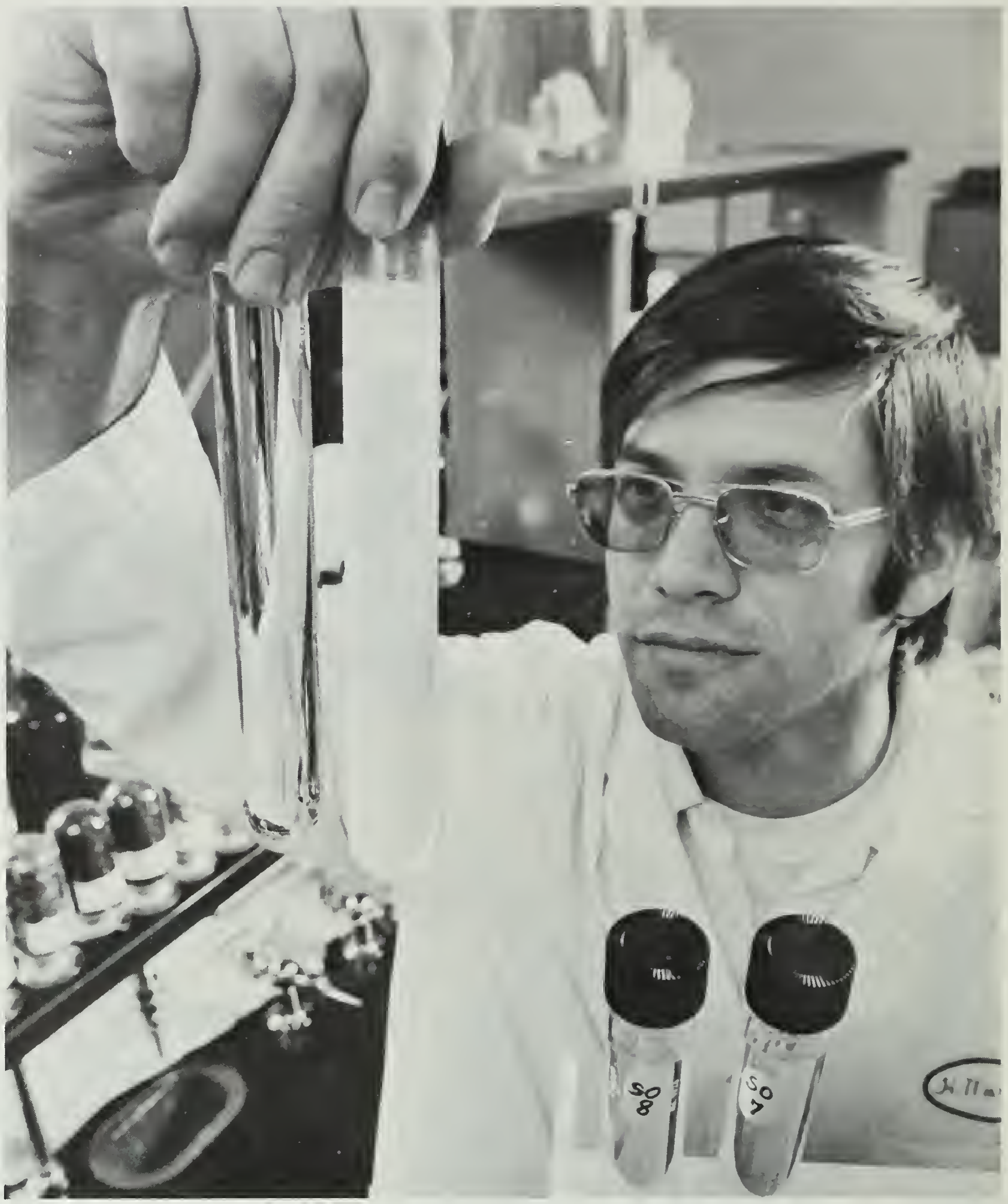
Ms. Smith removes rumen fluid from a fistulated steer. The rumen fluid is taken to the laboratory where tests are run to determine the digestibility of the fermented straw (1176X1469–15).

A 3-year pilot plant study funded by a $150,000 grant from the National Science Foundation is now underway in Corvallis. The large-scale production of fermented straw will enable Dr. Han and Dr. Anderson to study cattle reaction to their product. They are hopeful that the end of the pilot plant study will mark the beginning of a straw-feed industry.—*L.C.Y.*



Right: *In laboratory-scale fermentation experiments preceding the pilot plant studies, Dr. Han designed this instrument that rotates jars of straw to provide the continuous tumbling necessary for fermentation. In the pilot plant, four 4-inch by 3-foot paddles tumble the straw (1176X1465–5).*

Below: *Fermented straw ready to be fed to animals. Brown in color, the straw has a pleasant molasses flavor and contains 7 to 10 percent crude protein (1176X1466–6).*



Scientists at the Russell Research Center are seeking an optimum oil-solvent ratio and refrigeration temperature, called solvent winterization, that can be adopted by industry to provide a wax-free, clear, and therefore esthetically pleasing sunflower oil. Here, Dr. Morrison evaluates sunflower oil following solvent winterization procedure. The vial of clear sunflower oil indicates efficient wax removal potential, while the translucent oil indicates inefficient wax removal potential due to a less successful oil-solvent ratio and refrigeration temperature (1176X1489–28A).

Striking oil with sunflowers

EARLY American colonists called it "a great Hearte in form of a Marigolde, 6 feet in height, of the seeds heere of the Indians make both a kind of bread and broth." The sunflower today is also the source of a great oil. Second only to soybeans, sunflowers are one of the most important sources of vegetable oils in the world. First produced commercially for oil in the United States in 1967 when a limited acreage was planted to high-oil varieties from the U.S.S.R., sunflowers are just now beginning to attract widespread domestic attention and utilization.

According to a study by USDA's Economic Research Service, sunflowers could become an important cash crop in the Southern Cotton Belt States, as well as in the Red River Valley area of Minnesota and the Dakotas. Acreage planted to flax and cotton has declined, creating a need for alternate crops.

Supporting the prospects for increased production of sunflowers in the Cotton Belt are the yield potential of high-oil hybrid sunflowers; excess crushing capacity of southern cottonseed mills; increasing world demand for high-quality edible oils; and emphasis on the health benefits of polyunsaturated fatty acids.

In 1975, a total of about 1.2 million acres of sunflowers were harvested with about 300,000 acres harvested in Texas. Preliminary figures indicate that production of sunflower acreage was down 10 to 12 percent in 1976, but predictions are that it will be up again in 1977.

The effect of heat and frying on sunflower oil stability has been a part of continuing research by chemists James

A. Robertson and W. Herbert Morrison, III, Field Crops Research Laboratory (Russell Research Center, P.O. Box 5677, Athens, GA 30604). "The composition of the oil appears to be dependent on where the plants are grown," says Dr. Robertson. "Sunflower oil from seed grown up North typically contains 70 percent linoleic acid. Oil produced in the South generally contains 40 to 50 percent linoleic acid and is higher in mono-unsaturated fats and is more stable." Linoleic acid is a fatty acid considered essential in human and animal nutrition.

Frying studies indicated that the southern oil was more stable than the northern oil. Northern and southern oils were processed under identical conditions, and potatoes were fried in each oil. As expected, the southern oil, containing 38 percent less linoleic acid than the northern oil, was more stable after heating. A snack chip prepared in the oil had a longer shelf life, an important factor in the preparation of snack foods.

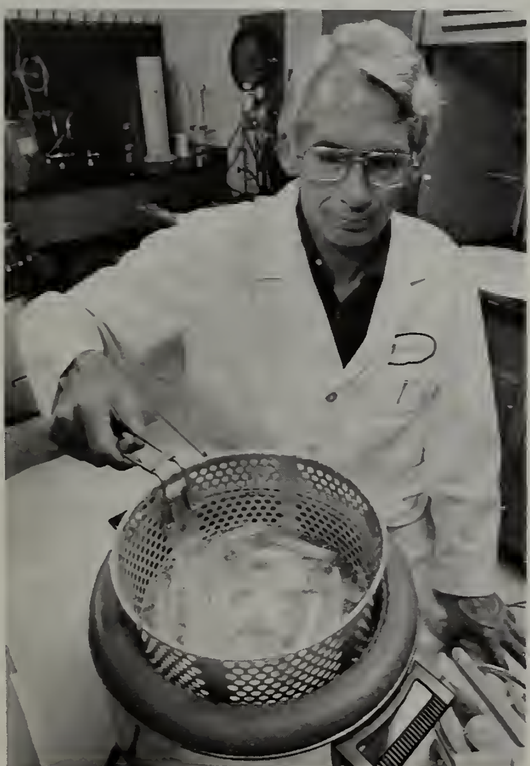
In addition, Dr. Robertson and Dr. Morrison found that partially hydrogenated sunflower oil performed as well as a standard cottonseed-corn oil mixture for frying potato chips. The stability of the oil remained good, and organoleptic evaluation—taste, flavor, and appearance—showed no significant difference in chips fried in either oil.

Studies also showed that the hydrogenated sunflower oil was more stable after extended use than a commercial shortening for frying french-fried potatoes. Stability measurements using the Active Oxygen Method values, an indication of the degree of oxidation as measured by peroxide formation, showed that after continuous use the partially hydrogenated sunflower oil was more stable than the commercial shortening. An informal taste panel found that the potatoes fried in the sunflower oil had a better flavor than those fried in the commercial shortening.

Because sunflower oil contains a high percentage of physiologically active polyunsaturated fatty acids (linoleic acid), it is of particular interest to people concerned with heart disease and blood cholesterol levels. Refined, bleached, and deodorized sunflower oil makes an excellent salad oil.

Although not harmful, waxes which appear as a cloudy suspension or a white precipitate in the bottom of the bottle when the oil is refrigerated have been difficult to remove using standard winterization procedures. Dr. Morrison showed that these waxes could be easily removed from solvent-extracted oil by refrigerating the oil-solvent mixtures (solvent winterization) and then filtering or centrifuging the waxes.—*P.L.G.*

French-fried potatoes sizzle in partially hydrogenated sunflower oil. Dr. Robertson found that the stability of sunflower oil remained good after extended use (1176X1490–8).



An informal taste panel composed of physical science technician Jack K. Thomas, Dr. Morrison, and Dr. Robertson munches on potatoes fried in partially hydrogenated sunflower oil. The verdict: They taste better than those fried in conventional oils (1716X1490–33)

Waterflow through the experimental sediment pond is continuously recorded at the Snake River Conservation Research Center, checked here by Mr. Bondurant and Mr. Brown. This pond, 50 by 4 by 200 feet, traps sediment from a contributing area of 70 acres. Flow averages about 110 acre-feet per year, and approximately 90 percent of the incoming sediment has been trapped. Sand and silt particles settle out of the incoming stream at the head of the pond, causing a delta through which the stream must then meander. The smaller clay particles are deposited toward the outlet end of the pond (0874X1359–3).

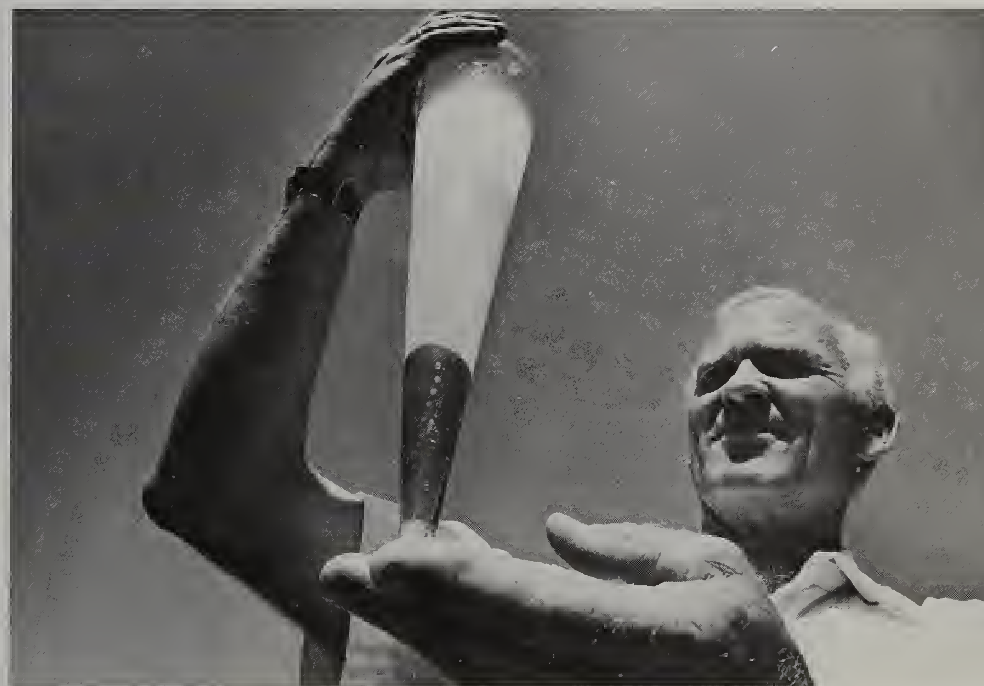
Ponds that Clean

SMALL MANMADE PONDS can combat sediment, the greatest pollutant of natural streams in the United States, and conserve precious water by effectively cleaning irrigation runoff water. Experimental sediment ponds monitored by ARS trapped 70-plus percent of the silt washed off irrigated farm fields during the irrigation season.

Sediment blocks our waterways, fills reservoirs, and destroys fish-spawning beds. Its deposits also reduce the carrying capacity of irrigation canals and may deliver unwanted nutrients into streams.

In irrigated areas, most sediment is soil, eroded from fields and carried to streams in the return flow of the irrigation water. Sediment ponds interrupt this flow of water. As the flow enters the pond, it should be quickly and uniformly dispersed so that forward velocity is reduced enough to allow sediment particles in the water to settle. The water is then discharged from the pond, free enough of sediment that it can be returned to the irrigation system.

ARS agricultural engineer James A. Bondurant, Snake River Conservation Research Center (Route 1, Box 186, Kimberly, ID 83341), and civil engineer C. E. Brockway, of the University



Below: *Mr. Bondurant uses a graduated cone for an on-the-spot check of the amount of sediment in irrigation runoff. This runoff water contained about 2 percent sediment, a fairly high value, indicating that considerable erosion was occurring on the field (0874X1360–34).*

Left: *The sediment sampler developed at the Snake River Conservation Research Center and installed on a potato field of a local farmer-cooperator is examined by Mr. Brown, Mr. Bondurant, and Mr. Brockway. The sampler's rotating disks can be adjusted to sample irrigation runoff water at specific intervals. Frequent, heavy irrigations and cultivations that loosen the soil in furrows as practiced by some farmers in this part of Idaho can contribute to sediment problems, although researchers are finding wide-spread acceptance by farmers of this new technology (0874X1360–16).*

Streams

The Snake River is comprised mostly of irrigation return flow during the summer irrigation season. Cleaning these irrigation return flows will greatly improve the water quality of the river. Flow averages about 2,500 cubic feet per second (71 cubic meters per second) during the summer months. About 30 miles above this point, almost all water from the Snake River is diverted for irrigation into two canals (0874X1358–36).

of Idaho, designed the ponds. A typical pond measures 200 feet long, 50 feet wide, 4 feet deep at the entrance end, and 40 feet wide at the outlet.

Ponds should be rectangular or triangular shape, with flow entering at the point of the triangle. Rectangular ponds should be a minimum of four times as long as they are wide, with the inlet in the center of one end. Using a full width skimming weir-type exit keeps exit velocities low so that more small particles are trapped. The exit section is leveled and covered with sheet plastic.

Where water enters the pond, the depth should be greater to allow suffi-

Ponds that clean streams

cient storage space for larger particles such as sand and silt that settle in a relatively short distance from the inflow. Pond depth can decrease toward the outlet if pond width is increased. This minimizes the distance smaller particles have to settle and the velocity at which they approach the pond's discharge end.

Sediment removed from the ponds can be used to fill low spots and gullies, and to level sloping fields to reduce runoff erosion. Although the sediment collected in ponds is low in available nitrogen, it is mostly valuable topsoil, containing adequate phosphorous.

If expectations are met in Idaho, other States dependent on irrigation should be interested.—*L.C.Y.*

Right: *Mr. Bondurant, Mr. Brown, and Mr. Brockway check the runoff from a plot which has been leveled with sediment collected in the pond. Sediment can be used to level sloping fields; with proper irrigation management, soil loss through runoff can be reduced. The flow from this plot is measured and recorded by the flume and recorder (0874X1359–22).*

Below: *Mr. Brockway and soil scientist Mel Brown inspect two newly constructed ponds near Wendell, Idaho. These ponds were designed for study of the effect of flow rate and entrance-exit configuration on sediment trap efficiency (0874X1358–32).*

CO_2 Saves Grapefruit

AGING brings the "uglies" to otherwise healthy grapefruit during storage. Carbon dioxide (CO_2) treatments at 21° C help keep them from developing stem-end rind breakdown, say Florida scientists.

Aging is reported to increase when grapefruit are exposed to 10 to 30 percent CO_2 at 4.5° C for 7 days and then stored at the same temperature. Prestorage treatments using CO_2 for 3 and 7 days at 21° C reduced the percentage of aging in grapefruit stored at 4.5° C for as long as 12 weeks.

The physiological injury called aging is also known as brown stem and burnt stem. The grapefruit may turn brown around the stem button and the oil glands may collapse. Decay follows at warm temperatures.

Horticulturalist Thurman T. Hatton and research technician Randall H. Cubbedge, U.S. Horticultural Research Laboratory (2120 Camden Road, Orlando, FL 32803), harvested "Marsh" grapefruit from three commercial groves in Indian River County, Fla. Fruit from four harvests over a 4-year period were washed, treated with 1,000 parts per million thiabendazole, graded, waxed with a solvent wax, and packed.

The treated grapefruit—4,800 fruit—were exposed to the desired CO_2 concentration—10, 20, and 40 percent CO_2—and placed in conventional air storage. Three controls were used: two were held at 21° C in air for 3 to 7 days before conventional air storage at 4.5° C; the other was stored continuously at 4.5° C. Relative humidity during storage ranged from 88 to 92 percent.

For exposure to CO_2, fruit were placed in gastight containers designed for controlled atmosphere studies. After an initial flushing with CO_2 to establish the desired concentration, the atmospheres were monitored continuously, and air, oxygen, or CO_2 was added to maintain proper CO_2 levels.

With prestorage CO_2 treatments, aging after storage decreased with increasing concentrations between 0 and 40 percent CO_2: treatments of 20 and 40 percent CO_2 resulted in significantly less aging than 10 percent CO_2.—*P.L.G.*

Solving the Mystery

SULFUR is an effective, cheap, and ecologically safe chemical for controlling powdery mildew on sugar beets. However, contrary to some recommendations, it is not necessary to apply the chemical to plants less than 2 months old.

ARS plant pathologist Earl G. Ruppel has discovered that sugar beets less than 6 weeks old are essentially "resistant" to the fungus that causes the mildew. As plants mature they become increasingly susceptible to the disease.

Dr. Ruppel recommends growers begin looking for mildew infections about 6 weeks after the plants emerge from the soil. If powdery mildew is found, an application of either 20 to 40 pounds of sulfur dust per acre or 10 pounds of wettable powder in at least 10 gallons of water per acre should control the outbreak.

If the mildew is not controlled, a second application 10 days later may be required. However, 90 percent of any increase in beet yield from chemical control usually is gained from the first treatment.

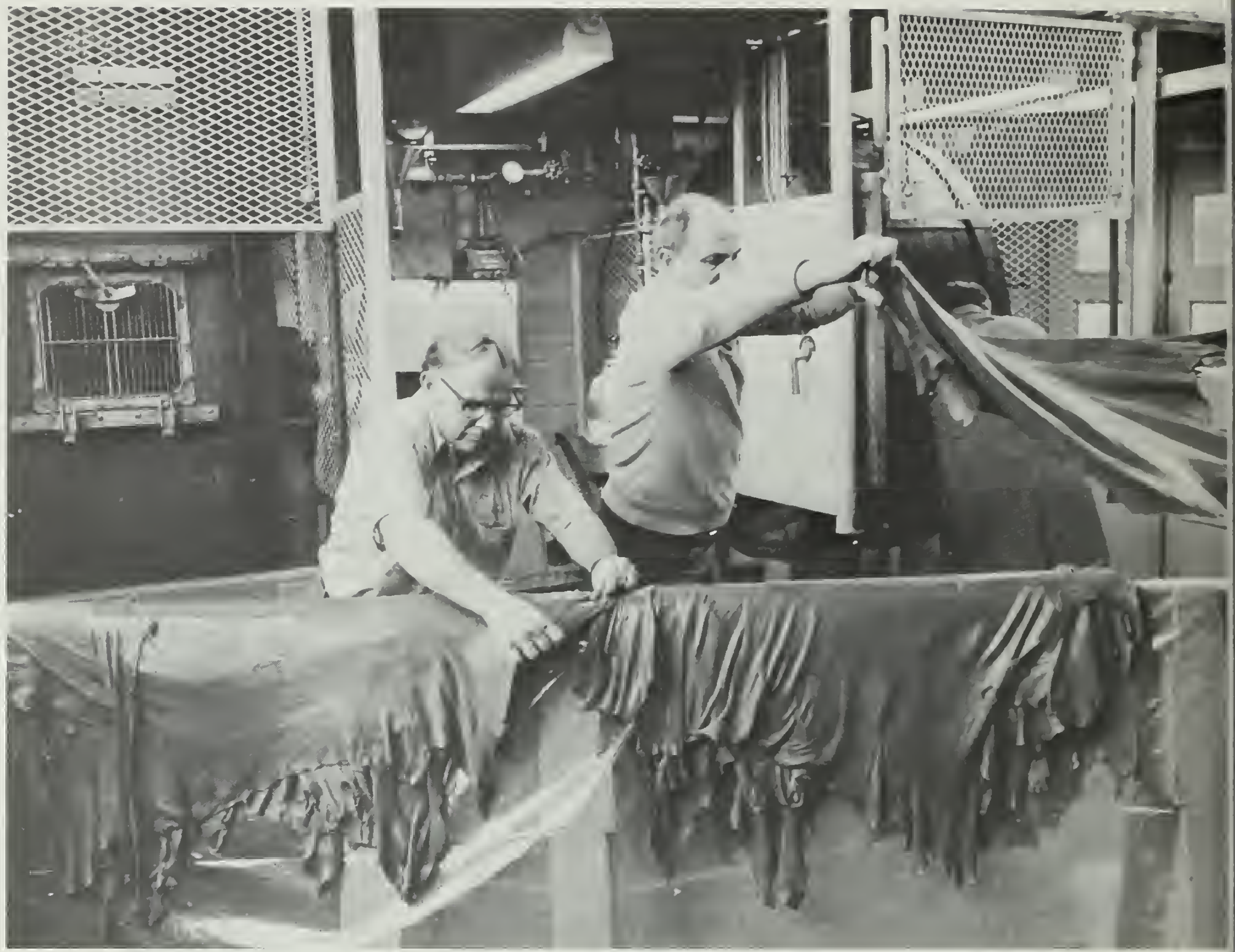
If powdery mildew infects crops 6 weeks or less before harvest, no chemical control is recommended. Any yield reduction will not be as great as the cost for sulfur and its application.

"Theories that the fungus is carried by the jetstream (a substratospheric wind, generally westerly, moving at a velocity as high as 200 mi/h) are unfounded," says Dr. Ruppel. "Our research indicates that the fungus is killed when subjected to −20° F, much warmer than temperatures in the jetstream."

Dr. Ruppel, at the Crops Research Laboratory (Colorado State University, Fort Collins, CO 80523), believes the disease fungus overwinters in warmer growing areas—Arizona and California. His research has not shown that the fungus overwinters in crop debris in Colorado. Rather he believes that the fungus "leapfrogs" northward and eastward from the Southwestern United States, being carried by the prevailing winds. Eventually the fungus affects every sugar-beet-growing State, even as far away as Michigan and Minnesota.

Research has also shown that powdery mildew growing on weeds cannot cause powdery mildew in sugar beets. The diseases are caused by different powdery mildew fungi.

Severity of powdery mildew has been less in recent years. This may be because of extensive chemical control in California and Arizona early in the growing season.—*D.H.S.*



Research chemist Alfred H. Korn (right) and chemical engineering technician Otto DeLucia pile the treated leather on horses to drain excess water. Essentially complete utilization of chemicals is realized in this combined final wet process (1176X1476–19).

Dry Cleaning Leather

Mr. DeLucia toggles treated leather on a drying frame. This permits further drying and minimizes wrinkles in the finished PolyRetan leather (1176X1476–26).

When leather garments can be drycleaned in coin-operated machines, it can be said that leather has truly arrived as easy-care clothing.

Such garments are not yet available to consumers, but there is an experimental model—a suede sports jacket made from leather processed by ARS scientists.

The new processing method is called PolyRetan. In addition to the easy-care feature, PolyRetan leather has improved strength and stretchability and will not support growth of mildew.

Most leather garments on the market now cannot be drycleaned by conventional methods. They must be sent to establishments with special facilities. This is an extra expense, takes extra time, and is an inconvenience for the businessman and the customer.

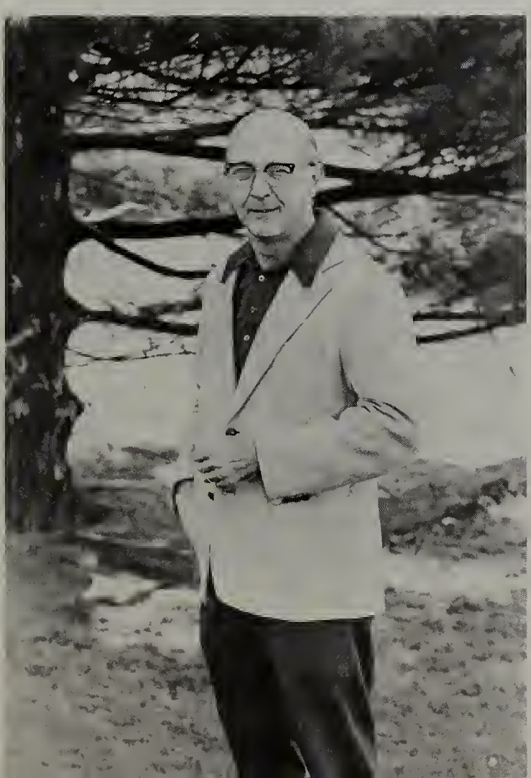
Chemists Stephen H. Fairheller and Samuel J. Viola (recently deceased) developed the PolyRetan process at the Eastern Regional Research Center (600 East Mermaid Lane, Wyndmoor, PA 19118).

The important part of the process is graft polymerization, a treatment in which leather is chemically combined with a synthetic polymer. Graft polymerization was developed in earlier research at the Wyndmoor laboratory.

To make the easy-care leathers, the PolyRetan process combines dyeing and fat-liquoring with retannage. Fat liquor lubricates and softens leather fibers. The polymers and dyes used in PolyRetan processing cost slightly more than the materials used in conventional processing. However, the process is simpler because polymerization, dyeing, and fat-liquoring are combined in one step. This should enable processors to offset most, and possibly all, of the extra cost for chemicals.

Since the synthetic polymer, the dye, and the fat liquor are chemically united with the leather at the molecular level and not simply coated, mixed, or impregnated, an essentially new fabric is made that resists drycleaning solvents.—*A.J.F.*

Research chemist Edward H. Harris, a codeveloper of the process, models a suede leather sports jacket made with the easy-care PolyRetan leather (1176X1475-20).



Improved Bread From Germinated Soybeans

FLOUR from germinated soybeans improves the nutritive value and flavor of high-protein bread made with a sugar-free formula.

Modification produced by germination, a combination of biochemical and physical changes, could contribute to improved digestibility and availability of nutrients, ARS chemist Y. Pomeranz says. High-magnification micrographs show particles of flour from germinated soybeans are somewhat more porous and more highly modified than particles of chemically modified or heat-treated soy flour.

Dr. Pomeranz says taste panels consistently approved the taste and flavor of breads made with three types of soy flour—germinated and heat treated, heat treated, and chemically modified. They generally preferred the bread made with flour from germinated soybeans, but the extent and significance of their preference need confirmation in additional tests. According to Dr. Pomeranz, earlier soy-fortified breads had been criticized for undesirable flavor.

Wheat flour averages about 11 percent protein, and the nutritive value of the protein is limited by deficiency of the essential amino acid, lysine. The amount of protein can be doubled and the lysine level tripled by replacing part of the wheat flour with soy products. But high levels of soy products seriously impair loaf volume, crumb grain, retention of freshness, and flavor unless the standard bread formula is modified in some way.

Use of flour from germinated soybeans is the latest advance toward consumer-acceptable high-protein bread by a research team at the U.S. Grain Marketing Research Center (1515 College Ave., Manhattan, KS 66502).

Dr. Pomeranz, food technologist Merle D. Shogren, and chemist Karl F. Finney in 1969 showed that substituting a small amount of wheat glycolipids for shortening in the formula prevented impairment of loaf volume and crumb grain and loss of freshness. Excessive browning of crust was overcome when the researchers substituted cereal malt for sugar (AGR. RES., Apr. 1975, pp. 8–9).

Commercially available, improved sucrose esters (which have yet to be approved for use in food in the United States) later proved as effective as those naturally occurring in wheat glycolipids. Ascorbic acid replaced part or all of the potassium bromate oxidant, and rising (fermentation) time was reduced more than 60 percent by increasing the amount of yeast in the formula.

High nitrogen solubility in soy flour usually is associated with poor bread quality, Dr. Pomeranz says. Flour from germinated soybeans has a high nitrogen solubility index, 45 percent, but quality was not impaired for reasons yet to be determined. Adding calcium chloride to reduce solubility of proteins in flours from germinated soybeans was neither essential nor did it improve bread quality, he found.

In contrast, chemically modified and heat-treated soy flours, with nitrogen solubility indexes of 12.1 and 7.1 percent, produced acceptable bread as expected. Soy milk powder, rated 48 percent soluble, did not.

Flour from germinated soybeans is commercially available in Mexico but not in this country, Dr. Pomeranz says.—*W.W.M.*

Harvesting on the Move

A NEWLY DESIGNED mechanical tree fruit harvester can harvest fruit more than twice as fast as current harvesters with much less operator fatigue.

The new harvester moves continuously down the row of trees in a straight line while a track-mounted device seeks out, grabs, and shakes the tree, dislodging the fruit. Fruit falls to an apron and is conveyed to pallet boxes for transport to the processing plant.

Many tree crops are harvested mechanically with a wide array of commercial machines that employ trunk shakers to remove the crop and inclined catching surfaces to collect the crop. However, all of these machines must stop at each tree where several operations are performed to control the shaker and position the collecting surfaces around the tree.

Improving these machines might improve the harvest rate slightly, say engineers Donald L. Peterson and Gordon E. Monroe assisted by Cecil C. Patterson, machinist, and Robert N. Gupton, mechanical engineering technician, at the Southeastern Fruit and Tree Nut Research Station (P.O. Box 87, Byron, GA 31008). However, the ARS researchers knew a dramatic increase in harvest rate could come only by developing a continuously moving harvester. This would mean eliminating all driver operations involved in positioning the shaker and catching the crop. It would all need to be done automatically.

The harvester consists of two independent, self-propelled halves—a shaker half and a collector half. The shaker half consists of the automatically sequenced trunk shaker, a fruit-catching surface, and a panel that automatically closes the gap between the two unconnected halves on each side of the tree to form a continuous, gap-free catching surface. The collector half also consists of a catching surface plus conveyors to transport the fruit to pallet boxes. All catching surfaces are covered with a 1-inch-thick layer of expanded polyethylene to protect the falling fruit. The collector half also has storage for four empty pallet boxes and provision for manually loading empty boxes from the side of the machine.

Operation of the shaker half of the harvester requires only one person whose duty is to drive the unit at a constant speed parallel to and within a specified distance from the tree row. A sensing device "feels" the tree and triggers a switch that causes the machinery to extend the shaker device and clutch the tree and extend the sealing panel to fill the gap between the shaker unit and the collector unit. While shaking the tree trunk, the shaker device slides backward along a track to allow the entire unit to move forward across the ground. When the shaking sequence is completed, the shaker and sealing panel automatically retract and quickly return to the forward end of the mobile unit and into position to contact the next tree.

Meanwhile, the collecting unit is on the other side of the tree row, directly opposite the shaker unit. The collector requires two persons, one to drive the unit parallel to the tree row and the other to control the bin-filling operation and signal when changing the pallet boxes is necessary.

Field testing was done on peaches with runs on trees spaced at both 9 and 20 feet. The harvester was run at a constant speed without speeding up when trees were missing in the row.

Results of the tests showed the continuously moving harvester to be at least 50 percent faster than conventional stop-go harvesters. Lowest harvest rate recorded was 155 trees per hour on peach trees spaced 20 feet apart. The highest rate was 284 trees per hour on peach trees spaced 9 feet apart.

Mr. Peterson and Mr. Monroe reported that harvest rates would have been higher except for the sluggish operation of the automatically controlled valves, resulting in longer sequencing time which in turn restricted groundspeed. Traveltime from tree to tree while completing a 4-second shake can be as low as 8 seconds for 9-foot spacings and as low as 10 seconds for 20-foot spacings. In the tests, traveltime averaged only about 14 seconds between trees for both spacings.

One of the main limiting factors to harvest speed is the amount of time required to change pallet boxes. This takes about 30 seconds; coupled with only a 14-bushel capacity container, box changing required as much as 23 percent of the total harvest time.

If a better bulk-handling system with a capacity of 150 bushels could be incorporated into the harvesting system, the researchers said the container changing time could be reduced to only 1 to 2 percent of total harvesting time.

Another limiting factor is short rows with many end turnarounds. During testing on small plantings, turnarounds took as long as 60 seconds, and there is little likelihood that the time can be reduced significantly. However, fewer turnarounds can be expected in commercial plantings.

Fruit removal rate was considered fair to good, but this could be improved by proper pruning and tree training. Where fruit removal was less than 95 percent, the researchers noted that the remaining fruit was all on long, thin hanger limbs which absorb the vibration rather than passing it down to the fruit.

Refinements have been made in the harvester and further testing on a larger scale in commercial orchards is expected during the peach harvesting season this year.—*V.R.B.*

AGRISEARCH NOTES

Birth weight: key to survival

THE HEAVIEST LAMBS at birth are most likely to survive. Incidence of lambing difficulty also increases as birth weights rise. But the greater viability of heavy lambs more than offsets death losses associated with difficult births.

Selection for increased size and growth rate in breeds developed to sire crossbred market lambs may therefore be carried out with little concern about lambing difficulty and preweaning survival, says ARS geneticist Gerald M. Smith. Sheep production efficiency can be improved by combining rapid growth as well as acceptable composition and quality with heavier slaughter weight.

In cattle, each 1-pound increase in birth weight was associated with about 1-percent increase in calving difficulty at the U.S. Meat Animal Research Center (P.O. Box 166, Clay Center, NE 68933). Death losses were about four times higher in calves born with difficulty than for those born without difficulty. Dr. Smith therefore analyzed data on some 6,700 lambs produced at USMARC to determine if a similar relationship exists in sheep. The lambs, nearly equally divided between purebreds and crosses, were produced in 1969 through 1974.

Dr. Smith found that deaths associated with increased lambing difficulty at heavier birth weights would be more than offset by increased viability at these weights for newborn lambs weighing up to 12 or 13 pounds. The heaviest lambs in the study, single-born crossbreds sired by Suffolk rams, averaged about 11 pounds.

Sire breeds considerably larger than those now available could be used with little effect on lamb survival, Dr. Smith says, if they are mated with prolific ewes—especially those containing Finn breeding. In the study, lambing difficulty was significantly less in multiple births, and these lambs averaged about 2 pounds lighter than single-born lambs.

The extremely low heritability of lamb survival indicates that direct selection for this trait in sheep breeding is unlikely to be successful, Dr. Smith says.—*W.W.M.*

An unwelcome guest

THE SCORPION, a member of the spider family, can arouse deep fear, perhaps as much from the stories and myths we hear in childhood as from its actual danger.

A species of scorpion, *Centruroides vittatus* (Say), that probably occurs in all the Gulf States as well as Kentucky, Tennessee, and Missouri, is not considered dangerously poisonous to adults and older children; however, it can be fatal to young children or to adults sensitive to its sting.

In the Southern States, from May to August, this fellow has the noxious habit of invading houses to escape the summer heat. In hopes of discouraging the visits of this unwelcome guest, ARS entomologist Darrell I. Darrow, U.S. Livestock Insects Laboratory (P.O. Box 232, Kerrville, TX 78028), tested 12 insecticides against *Centruroides vittatus.*

Mr. Darrow tested the insecticides by exposing scorpions to residues on filter paper. His results show that both lindane and chlorpyrifos are quite effective, killing scorpions at the very low dosages of 0.3 and 4.0 micrograms per square centimeter, respectively. One microgram per centimeter translates to approximately 10 milligrams per 10 square feet.

Dichlorvos, diazinon, and propoxur were also relatively effective at low rates of application on the filter paper.

Interestingly, DDT, long recommended for the control of scorpions, was essentially ineffective at the relatively high rate of 1,000 micrograms per square centimeter.

"Chlorpyrifos is the most promising of the insecticides tested," said Mr. Darrow, "because, unlike lindane, it does not incite the scorpion to nervous activity, with the danger that it might sting in its excited state."—*B.D.C.*

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AGRISEARCH NOTES

Crop-environment computer match

A COMPUTERIZED retrieval system which can help locate plant materials with tolerance to various specific environmental stresses is now in operation at the ARS Beltsville Agricultural Research Center.

The system, which keeps data on the growing season, temperature range, rainfall requirements, locality, elevation, pH range, and other environmental factors affecting 1,000 economic plants, was organized by research botanist James A. Duke, Plant Taxonomy Laboratory (BARC-West, Beltsville, MD 20705).

To aid agronomists and plant breeders in finding crops or germplasm which will tolerate adverse or marginal conditions, Dr. Duke has been gathering data on the environments of 1,000 crops from scientists and agricultural experiment stations worldwide.

Although the data base is still being expanded by additional reports from experiment stations throughout the world, the system is now operational. By filling out a questionnaire which describes their particular environment, correspondents can find out which crops are best suited to their particular area.

Other ARS scientists at Beltsville have already used the system to locate a promising iron-efficient sorghum that will be useful in alkali soils.—*J.P.O.*

Two with one

RONNEL, a commonly used systemic grub control chemical for cattle, also increases gains by improving feed utilization.

Ronnel is fed to cattle to control cattle grubs, the larval stage of heel flies. Newly hatched grubs burrow into the cow near the hoof and migrate through body tissues to the back of the animal. The grubs then burrow out through the skin, damaging the hide.

Animal scientist Theron Rumsey (Room 132, Bldg. 200, BARC-West, Beltsville, MD 20705), found that when ronnel was added to the diets of steers, they gained an additional 12 percent over steers not receiving ronnel. None of the steers were infested with cattle grubs.

Dr. Rumsey fed 18 steers a 70-percent concentrate diet for 14 weeks. Half of the steers received ronnel. The cattle were fed 1.75 percent of their body weight in feed daily for the first 7 weeks and were fed free choice for the last 7 weeks.

Cattle on the diet containing ronnel gained more weight on the same amount of feed than those not receiving ronnel. The results of this trial confirmed the results of a previous trial conducted on ronnel at Beltsville.—*M.E.N.*

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